Developing Learning Toys for Learning Measurement Concept in Early Childhood

Syafdaningsih[1,a], Sri Sumarni[1] and Dina Juniarti[1]

[1]*Early Childhood Education Department, Universitas Sriwijaya, Indralaya, Ogan Ilir, Indonesia*

Keywords: Measurement, Learning Toys, Early Childhood.

Abstract: This study aims to describe measurement learning toys in geometry learning for early childhood. The participants were 5-6 years old. The Rowntree's development model that consists of three phases, namely planning, development and evaluation were used to develop the product. To evaluate the product, the formative evaluation proposed by Tessmer comprised self evaluation, expert review, one-to-one evaluation and small group evaluation were used. Data was collected by using walkthrough with media and learning material experts. The results showed that the measurement kearning toys had score of 3.75 out of 4,00 which was high validity. One to one evaluation was 88% (good) and small group evaluation result showed the average percentage was 94% (very good). These results showed that the learning toys for learning measurement concept was practical for early childhood.

1 INTRODUCTION

One of kindergarten education goal is to help children to develop both physical and psychological ability. These processes include behaviour development that consist of religion value and morality, social emotional, as well as basic ability development namely language, cognitive and physical skills.

The development of pre-school children's cognitive ability occurred at the age of two to seven years old -that is in preoperational stage. This is the second stage of cognitive development according to Jean Piaget. In this stage, learning process is still dependent from concrete objects and direct experiences of children-themselves. One of the exciting activities is by using concrete media, includes learning about measurement concept.

Measurement is defined as assigning a number to continuous quantities (Clements & Sarama, 2004). Measurement is consisted of size, generally about opposite things like big-small, long-short, wide-narrow, thick-thin, deep-shallow, rough-smooth. Measurement is one of the most useful mathematical skills. Measurement involves assigning a number to things so they can be compared to the same attributes. Numbers can be assigned to attributes such as volume, weight, length, and temperature (Charlesworth, 2005). For example, a child drinks one cup of milk. Numbers also can be expressed in time measurement. Based on our observation in Public Kindergarten Pembina 1 Palembang, children's ability in measurement was still lack. Children had small chance to interact directly in measurement activity. Teacher usually just asked the children to practice on their worksheet and without any learning toys as media. Learning toys that are attractive and interesting then is needed.

2 RESEARCH METHOD

This research used development research method. Development research is concerned with finding out about the causes, consequences, and ways of tackling poverty (Hammett, Twyman & Graham, 2015). Focus on this method is for produce a media which are modification media: Rowntree and Tessmer. Tessmer outlines 11 steps that are necessary when planning an evaluation: 1) Determine the goals of the instruction; 2) Determine the resources for and constraints upon the evaluation; 3) Obtain a complete task analysis of the instruction; 4) Describe the learning environment; 5) Determine the media characteristic of the evaluation; 6) Outline the information sought from the evaluation; 7) Choose parts of the instruction for evaluation; 8) Select the stages and subjects for the

evaluation; 9) Select the data gathering methods and tools for each stage; 10) Plan the report(s) of the evaluation; and 11) Implement the evaluation (Ogle, 2002).

The participants of this research were Public Kindergarten Pembina 1 Palembang students (5-6 years old). One to one and small group process involved three children and nine children was in field test. Research procedure in Rowntree model that implemented in this research was following the three phases as follows.

2.1 Planning Stage

Need analysis was the first step of planning stage. The analysis was about students' need and learning media, especially introduction of measurement material by analysis learning media and interviewing the teachers in Public Kindergarten Pembina 1 Palembang.

2.2 Development Stage

2.2.1 Design Stage

On this stage, researchers design product in a form of learning measuring toys. Design development has to be suitable with early childhood curriculum, playing tools characteristic, playing tools requirements, and targets that the researchers want to achieve. The target is the mastery of measuring material learning for 5-6 years old children after using measuring material game.

2.2.2 Prototype Production

After arranging the design, the next step is prototype product. The design that had been designed is converted to be playing tools. Every part of design is presented in the form of playing tools that consist of measure material. The result of all of the development stages is called Prototype 1.

2.3 Evaluation Stage

On this stage, the earliest design prototype will be evaluated by following format from Tessmer (1993) with steps described on below:

2.3.1 One-to-One Evaluation

On this step, measuring material game is implemented to children permainan Researchers choose three children randomly for deputized target population which are children with low, medium and high ability. Those children will be given learning material with prototype 1 that has been revised. On the learning process by

observation sheet that has been provided for seeing and assuming directly the behaviour or the process of learning activity by implementing prototype 1. This is implemented for considering the practical usage of playing tools viewed from children's perspective. That observation result will be the basic for revising product (prototype 1) which will produce prototype 2.

2.3.2 Small Group Evaluation

On this stage, prototype 2 is tested for small group of children that consist of 9 students. Next, children will be given learning material with revised prototype 2. On the learning process, children will be observed again for seeing and assessing directly the behavior or process of learning by using learning material using playing tools (prototype 2).

Data collecting technique for this research is: Walkthrough. The classroom walkthrough is considered one important tool among many used to achieve school improvement (Stout, Kachur & Edwars, 2010). Walkthrough is data validation that involving some experts for evaluating product as the base for revising early product or prototype 1.

Data collecting instrument in this technique is by using validation sheet that given to experts or valuators. Data collected on validation sheet are in form feedback and suggestions which become basis for researchers to revise on early product (prototype). Data from validation result by expert is used for receiving information explication about product validation, so researchers can use validation result data as the reference for revise product or prototype until they are declared as feasible to be tested.

In this research used an assessing behaviour viewed from children's activeness on learning activity by using mathematic illustrated story book. The method for achieving observation data is by directly observing and assessing the activity and behaviour of children learning process by using mathematic illustrated story book. The purpose of observation is we can watch someone or something passively and without an expressed intent, observation is seen as a means to an end—as helping to answer a specific question that has been posed (Briesch, Volpe & Floyd, 2018). Observation is done on *one-to-one*, *small group,* and *field test*, whether it has already implemented good or not by using mathematic illustrated story book.

Walkthrough result with experts is analysis descriptively as suggestion for revising book. The suggestion is written again in validation sheet. Validation sheet given for experts is in a form of likert scale. A likert scale invites individual to rate their level of agreement or disagreement with items measuring their attitudes or perceptions. While

traditional likert-type items have 5-point rating scales, the number of points may vary (Sullivan). According, likert scale consist four answer categories: Very Good (VG), Good (G), Not Good (NG), and Very Not Good (VNG). The validation result from valuator is presented on a table that has been calculated into mean number. That score used Formula (1).

$$x = \frac{\sum X}{N} \qquad (1)$$

with: x   = Mean score
    $\sum X$ = Total of data score
    N = Numbers of data

Table 1: Category of picture validation level.

Mean	Category
3,25 – 4,00	Very Valid
2,50 – 3,24	Valid
1,75 – 2,49	Not Valid
1,00 – 1,74	Very Not Valid

Observation results to children during trial on one-to-one evaluation, small group evaluation, and field test are used for viewing children's behavior during learning process using mathematic illustrated story book. Observation result data are presented in a form of table and then calculating observation result data by using formulation.

$$\text{Percentage Score} = \frac{\text{Achievement Score}}{\text{Maximum Score}} \times 100\%$$

Table 2: The categories of children observation result toward usage of mathematic illustrated story book.

Score (%)	Categories
80-100	Very Good
70-79	Good
60-69	Moderate
<60	Low

3 RESULTS

The result of this research is about developing produces a media in the form of measurement materials games for young children. Children can learn to measure objects about length-short, height-small, heavy-light, and big-little by using this games. This game consists of a storage box, a hollow board (geometry shaped), a peg board, a measuring board, and a scale tool. The five media are contained in one box (5 in 1), so that a children can easily to play it.

This research started with planning, development, and continued with evaluation that is formative evaluation. Researchers developed measuring material in a form of playing tools. Research procedures are elaborated as follows:

3.1 Planning Stage

On the planning stage, researchers observed and gave interview on 1 September 2017 on group B assigned by Mrs. Sri Mulyati as a teacher in Public Kindergarten Pembina 1 Palembang. Several things that caught researcher attention on observation and interview are learning process, children activity, availability and usage of media, and obstacles for teachers and school.

3.2 Development Stage

Activities on this stage were make drafting product of measurement toys. We designed learning toys by following some criteria from Education and Culture Ministry for Early Childhood Education. The learning toys made from plywood for durability and colored with primary colour and secondary colour paints.

The rest of development stage result was the prototype 1. On development stage, it also prepared evaluating children behaviour toward the usage of measurement learning toys.

3.3 Evaluation Stage

3.3.1 Expert Review Stage

Expert review stage result was implemented by testing measuring material game. The implementation was tested by two experts-content or material expert and learning media expert. The average score of expert review validation result for content or material aspect was 3,75 (very valid category). Therefore, developed measurement learning toys was proper to be tested with any comments and suggestions from evaluators.

3.3.2 One-to-One Evaluation

This stage involved children with high, average, and low ability and they were implemented with prototype 1. On the learning process using prototype 1, they were observed by researchers. We observed and evaluated children's activity and behaviour toward prototype 1. Percentage score of mean number children observation toward the usage of measuring material game on one-to-one stage was 88% (very good category).

3.3.3 Small Group Evaluation

Revised prototype 1 from one to one stage result, in small group evaluation stage the product was tested to

nine children in the group. In the small group evaluation, children were observed again toward their activeness on prototype 2. Percentage score of children observation average result toward usage of measurement learning toys in small group evaluation was 94% (very good category). Therefore, it can be a good product from appropriateness and practical aspects.

Figure 1: Revised blocks sample. Material, and weight are equal.

Figure 2: Revised and coloured triangle and square holes.

Figure 3: Revised giraffe length measurement toys.

The average score of expert review validation result for toyss content or material aspect was 4,00 (very valid category) and for the design was 3,5 (very valid category). Therefore, it can be achieved the average score of experts validation result was 3,75 (very failed category) because of the adjustment of measurement toys with indicator of material and media experts. Therefore, measuring material game is appropriate to be tested with several comments and suggestions from valuators.

Figure 5: Children playing measurement toys.

Percentage score from observation result average number toward the usage of measurement toys in initial field trial was 88% (very good category) so it can be concluded that the usage of the toys had practical criteria for children because corresponded to children observation indicator. There were several parts that became a concern by researchers on one to one result for revising developed media, because one of children played on geometrical shaped play toys: triangle and square that were used for introducing big-small concept-had problem on putting them on triangle and square shaped holes. Therefore, researchers revised the product again to game making expert for fixing the edges of triangle and square shapes.

The average score of children observation for the usage of measuring material game on small group evaluation stage is 94% (very good category), so it can be concluded that the usage of measuring material game has practical criteria for children so that it can be a good product from appropriateness and practical aspects.

Children can play this toys with easily and without assistance from adults (independent). Because this game have not many rule. On the scale tool, a child takes some of the things that he/she likes. Then he/she put the objects in the place of scale. Children can compare, which objects are heavy and light?. On the measure board, a child takes some of the things that he/she likes. Then he/she put the objects in the measure board. Children can compare, which a long and short objects?, On the peg board, a child takes some pegs. Then insert the pegs in the order of height. Children can arrange pegs according to their order, etc.

The importance from media is where the children learning process and result show significant difference which means there is a significant difference between learning without media and learning with media, so the existence of media for teaching kindergarten students is educative games tool. There are many possible advantages of the use of games-based learning, such as increase motivation

and engagement, an enhanced learning experience, and improved student achievement and student retention (Connolly, 2011). Educative games is a thing that can be used to become a facility or tool for game which has educative value and develop all of children's ability.

4 CONCLUSIONS

Based on research findings, the researcher succeeded in developing of measurement material games for young children. Measurement material games that had been developed is declared as very valid based on the validation of expert review. The expert review is consisted of content or material and design experts review so that measuring material game is appropriate for teaching material for measuring material. It can be empirical evidenced by the result of expert review on measuring material game for a number of 3,89 (very valid category).

For testing the practicality of measuring material game can be viewed from its easiness for usage. Based on one to one evaluation stage on measuring material game, it can be achieved as 88% (very good category). Based on *small group evaluation* stage result, it is achieved the average number of measuring material game for 94% (very good category). Therefore, it can be concluded that measuring material game is valid and practical to be used for students in group B at Public Kindergarten Pembina 1 Palembang.

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